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P. M. M. Thomas
Compliments
PRACTICAL OBSERVATIONS

ON

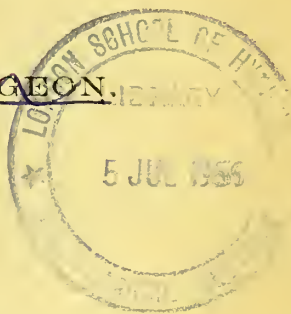
PUBLIC HEALTH.

ASIATIC CHOLERA:

ITS CAUSE AND CURE.

WITH AN IMPROVED METHOD OF
TREATING THOSE SUFFOCATED BY DROWNING, CHARCOAL, AND
THE POISONOUS GASES IN GENERAL.

BY C. RICE, ~~SURGEON~~
2



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PRACTICAL OBSERVATIONS, &c.

IN presenting to the notice of the profession and the public the following observations on a disease which has hitherto baffled all inquiry as to its origin and cause, I am actuated by purely philanthropic motives, disclaiming anything like dogmatism or dictation, but inviting abler pens to a more extended field of investigation, pathological inquiry, and inductive reasoning.

In the number of its people consists the real wealth of a state; its first duty, therefore, is to watch over the health of the public, and promote the comfort, the well-being, and the happiness of those committed to its care. The government, whatever may be its type or constitution, that fulfils this duty best, is the wisest and most paternal, and will command the respect and admiration of all; and will, in return, be repaid by the gratitude and attachment of its subjects. And herein also consists the strength of a nation; the governors and the governed are bound in one golden link of reciprocal duty, and may safely defy enemies abroad and traitors at home—the compact is *inviolable*.

A people are happy and prosperous in proportion to the facilities afforded them for the development of their mental, moral, and physical energies, and the fewest hindrances to remunerative industry.

The laws of health and disease, though in some instances anomalous and complicated, are daily becoming better understood; and science, aided by philanthropy and benevolence, is constantly devising means to protect the health of the public, by removing the predisposing causes of disease when these are patent, and meeting disease itself more efficiently and promptly.

Still, it is matter for regret that the spirit which has been awakened on this subject travels at a slow pace, and is met in many places with coldness and indifference. And it is only on the actual appearance of disease—some dire scourge, cholera or typhus

—that we are roused from our lethargy, and made painfully sensible of our want of forethought and preparation to meet the common enemy. But we should always be in readiness, and prepared to ward off any attack; and, as prevention is better than cure, we should do all in our power to remove or prevent the predisposing causes of disease, for it is these that feed its virulence and strengthen its activity.

The principal conditions of health are—personal cleanliness, pure air and water, proper ventilation, wholesome food and in sufficient quantity, avoiding surfeits, clothing suitable to the person and the season of the year, dry locality, avoiding damp situations and damp dwellings, a tranquil mind, and regular habits generally, and abstinence from all intoxicating liquors, and all unnatural stimulants, opium, &c., except by order of a medical man, in those *rare* cases of disease where a limited use of them may be indicated. The converse of these, or of any one of them, shows itself in a derangement of some part of the system corresponding to the cause which has produced it, the length of time it has been in operation, and other collateral circumstances. One of the principal objects in carrying out any plan for securing the health of the people and protecting them from disease, is to improve and enlarge their dwellings, and make them as comfortable and convenient as possible; and although in many places a step has been taken in the right direction, and something done towards the accomplishment of this object, I regret to say it is nothing like general, which it ought to be, if we *really* wish to elevate and benefit the masses. There appears to be a want of spirit about the matter, a reprehensible supineness, which nothing can excuse or palliate, and which, it is much to be feared, nothing short of some wide-spreading and death-dealing pestilence will remove. Men seldom think seriously till the danger is at their door, and then it is, unfortunately, too late. This is a matter which concerns all of us—the rich as well as the poor, the lordly occupant of the castle as well as the humble peasant in the cottage. Disease is no respecter of persons; and let the wealthy remember, if it begins in the hovel, it not unfrequently ends in the hall. Give the masses comfortable dwellings, and you in a great measure prevent disease. By it also you elevate their condition, and give them self-respect, and a decent and manly pride, and strengthen all the social and domestic virtues. How can a man esteem himself as he ought—and if he is educated he must feel his degradation the more acutely—when he casts his eyes round the dark and dingy apartment, the garret or cellar it may be, in which he and his miserable family are,

as it were, stowed away like so much living lumber? It is enough to deprive him of what little spirit he has left, and sink him almost to the level of the brute. Notwithstanding the spread of education, and the more general diffusion of knowledge among the people, crime is still on the increase. How is this? The cause, it is evident, must be looked for elsewhere than in the mere want of mental training, or regular instruction in the arts and duties of life of the masses. Education is all very well, and no one values it more than I do; but I consider it second to comfortable dwellings for the masses, and the supply of their physical wants and necessities. This accomplished, educate them as much as you please—their altered condition will make them apter scholars, and the next generation will have sufficient mental and moral stamina to support itself, and give an impetus in the same direction to the one that is to succeed it; and thus may improvement and education go hand in hand, building up the social edifice, until it appears in all its goodly proportions, towering aloft a thing of beauty and grandeur, rising majestically to heaven, with the rainbow of promise encircling its head and shedding around it a celestial lustre. The most prolific source of disease amongst us is intemperance—two-thirds of all the diseases that affect the people of this country have their rise, directly or indirectly, in this vice; it lies at the heart of the nation as a consuming fire, silently but surely wasting and destroying its energies, and drinking its vitality.

Let us visit the great city—the emporium of trade and commerce, with its teeming thousands, all intent on making money as their chief good—explore its back alleys and noisome lanes, where the light of heaven struggles to find entrance—and what do we see? Multitudes of miserable beings labouring under almost every disease of mind and body, gaunt from want like walking spectres, and yet spending their last penny at the grog-shop—worshipping intemperance as some dreaded deity, and offering their existence at his hated altar—quaffing the poisoned cup to his honour, as the Carthaginians propitiated the deity of their worship, by flinging their children into the fire which burned within his brazen image. What a fearful picture is here! and yet the canvas is only partially filled. An evil of the greatest magnitude, feeding on the vitals of the nation, poisoning the fountain of life at its source, blasting reputations, withering hopes, bringing desolation and ruin into families, and breaking many a loving and tender heart, and nipping many a household flower, the envied and the loved, in the noonday of its pride and the fulness of its loveliness—intemperance may be termed

the root of crime, disease, and destitution. From the general defect of vital power in the system, the children of drunkards are neither numerous nor healthy. They are usually puny and emaciated, and more than ordinarily liable to inherit all the diseases of their parents; their intellect is also, in most cases, below the general standard. Drunkenness, according to the reports of Bethlehem Hospital, and other similar institutions for the insane, is one of the most common causes of lunacy; and there are few but must have witnessed the wreck of the most powerful minds by this destructive habit. It has a more deplorable effect on posterity than any other practice; for it entails not only bodily disease upon the innocent offspring, but also the more afflicting diseases of the mind.

Next to healthy and convenient dwellings for the poor, public baths (free) and gymnasiums, promenades and play-grounds recommend themselves—cleanliness and exercise, the two most essential things for the health both of body and mind. The Romans were so fully impressed with the importance and utility of these, that they had baths and gymnasiums in almost every town and village under their authority. The remains of many of these have been discovered in this country, and they are at once an evidence of the skill and civilization of those who constructed them, at a time when most of the nations of the earth were little better than savages, or had scarcely emerged from barbarism. Many of the Eastern nations, indeed I should say most, consider ablution of so much importance—no doubt, from having experienced its health-giving properties—that it forms, at this day, an essential and indispensable part of their religious duties. Air, food, and exercise, pure water, and comfortable dwellings, are absolutely necessary for vigour of body and mind, serenity and long life. We must often revert to first principles if we would introduce reform or salutary customs for the government of health, the propagation of morals, or cementing and strengthening the social system. The nations of antiquity had many excellent customs founded on experience, and which the modern would do well to imitate, and those I have mentioned are of the number. They are in accordance with the law of our nature, and stamped with the approval and practice of a hundred generations. Free baths to the public all over the country would be a great boon, an incalculable benefit; and I trust we shall soon have them in every town and village in the three kingdoms. Such an improvement in our sanitary system would not be long in manifesting itself in the decrease of disease, and the more healthy and moral condition of the people. In order to know the actual

state of the people and their circumstances, I would suggest the formation of a society or brotherhood, to be called the "Friendly Visitors," the duty of which would be to visit every house in town and country, inquire into the circumstances of the people, their present condition and future prospects, their state of health, and any other matters that might suggest themselves, bearing on the subject, during their visitations. These visitations to be at stated periods, not less than four times a year, or once a quarter. In this way many valuable facts might be elicited, and much useful information obtained—a book to be kept to enter any particular facts in, and the proceedings of the Society in general. A great amount of good might result from this plan, and evils remedied or brought to light that might otherwise never be known. It would strengthen friendships and create sympathies among men; it would touch the kindest chords of our nature, and let the people see that there were those who *really* cared for them, and took an interest in their welfare, and regarded their happiness as men and as brothers. In this plan religion and sectarianism to be carefully avoided. It is a system of pure philanthropy, and, as such, should know neither creed, country, nor colour. It is neutral ground, on which men of every shade of opinion might safely meet without compromising any of their respective opinions. The mission is to their fellow-men, on purely secular and physical interests, and has nothing whatever to do with speculative opinion, or religious dogma; therefore, I repeat, if you wish to do good, let them be avoided. Such a society or philanthropic brotherhood would, in addition to the benefit they might confer on the public, greatly assist the different boards of health, by the information they would be enabled to furnish them with, from time to time. Having brought this plan before the public, I leave it in their hands either to adopt or reject, as they may think proper. It is, however, worthy of serious consideration; and it only requires to be tried, I think, to prove its utility. There is no want of well disposed people in town or country, I flatter myself, to lend themselves to the good work. Scientific truths are slowly evoked, and as slowly admitted. One man utters an opinion, or throws out a hint, but is unable to do more. He stops short at a certain point, and is unable to go farther. Another takes it up, and carries it to a more successful issue, and so on, until some more expansive and higher intellect completes the marvel, and brings it out in its full proportions, invested with all the attributes of originality, beauty, and perfectability. We walk by the lights of those who have preceded us,

and slowly, and as a miser who increases his riches, we add to the store for the use of those who are to succeed us, and who are destined to travel in the same path; and so man has emerged from his state of barbarism and ignorance, and advanced by degrees to refinement, knowledge, and civilization, and built up for himself an empire and a name which will survive the wreck of ages, and the downfall of thrones and dynasties.

Though the great laws which govern the universe are fixed and unchangeable, those which govern matter are subject to a variety of modifications—simple and complex, increase or diminish—but in the slightest degree one of two compounded substances, and they immediately pass under new laws, and become totally different in their character and properties, presenting to the student one of those endless but wonderful phenomena which are constantly resulting from chemical combination and affinity, and not unfrequently exerting an influence on society itself, and giving a new turn to its prospects and its energies. This, it is well known, chemistry has accomplished in almost every branch of art and science, opening up new and improved avenues to health and wealth, and directing the mind into fresh channels both of knowledge and power, and imparting to it an almost superhuman agency. If chemistry is so wonderful in the arts and sciences, and its application in abstruse and delicate investigations, beyond the reach of any other agency, surprising and conclusive, further experience may prove it no less powerful and prolific of disease in its atmospheric combinations and changes. It may hereafter be discovered that the chemistry of nature, in its various modifications, influences or produces most of the diseases that afflict the world. If this should turn out to be the case, it will cause a great revolution in medical science, and greatly simplify medical practice. Certain diseases are known to prevail at certain seasons of the year, or during certain states of the weather. The state of the earth consequent upon these changes, the electrical currents, and other occult and hidden causes, influence, or give rise to disease. Planetary influence, not only on the person, but on the earth, also, would seem to have a share in deranging health and producing disease. Observation and experience have long since established the fact, that Typhus and other fevers are produced by animal and vegetable refuse which have been allowed to accumulate, stagnate, and rot, in the localities where such disorders prevail,—loading the air with noxious exhalations and impurities, which are taken into the lungs, destroying the equilibrium of action, and saturating the whole system with a morbid compound

poison. On the contrary, wherever sanitary measures are strictly carried out, the reverse has almost invariably been the case—the inhabitants have enjoyed all but entire exemption from those diseases; and when they do occur occasionally, they are comparatively mild, and sooner give way to the usual treatment. This every medical man of the least experience knows. This shows the great importance of removing filth and other nuisances from the neighbourhood of inhabited dwellings, and where it may by any possibility contaminate the air in the immediate vicinity. The poison of cholera, I have little doubt, is communicated to the system through the medium of foul or vitiated air; indeed, it may consist in a peculiar state of the air itself, assisted by the predisposing causes opposed to the conditions of health already noticed. Some people are very susceptible of disease, and which is decidedly favourable for an attack of cholera. Vitiated, or noxious air is undoubtedly the common and ordinary vehicle that conveys this poison into the lungs, and thence to the whole system. Imperfect drainage in large towns, and confined and overcrowded dwellings among the poor in town and country, particularly in the former, are evils of the greatest magnitude. They contribute to spread this disease in a fearful manner, and cannot be too soon remedied. On the first appearance of cholera in this country, in 1831; I had three very bad cases of it, one of them collapsed, and they all recovered by the use of *oxygen*. I gave Plummer's pill in pretty large doses, to act on the secretions, and directed a mixture composed of Spir. Terebinth and Tinct. Opii. to be rubbed on the skin, to keep up the heat of the surface, and remove spasm. Almost simultaneously with this, I caused the oxygen to be inhaled by the patient, and the remedy acted as if by magic. Every symptom subsided in an incredibly short space of time, leaving little else than weakness behind. It is to the absence of oxygen, or its deterioration in the air inhaled by choleraic patients, that I attribute the disease. Now, if this be the case, it is very clear that nothing is so likely to remove it as the exhibition of this great agent in an unsophisticated state, or diluted with common or pure air, as the case may be, according to the urgency or mildness of the symptoms. The more violent the attack, and the longer it has continued, the stronger the gas will require to be, and the less diluted, and *vice versa*. In the last stage of the disease let it be used pure, until a marked effect is produced, decidedly beneficial; then withdraw it for a while, and if the symptoms do not entirely subside in a reasonable time after, give the gas again, mixed with common air, and continue

this practice at intervals, till the danger is over, and recovery no longer doubtful. As the state of mind has a marked effect on the secretions, it should, in this disease, be smoothed and tranquilised as much as possible. Oxygen, as is well known, is a supporter of animal life—the only simple supporter of it—and an indispensable component of every compound supporter of it with which we are acquainted; and hence its great and paramount importance in the animal economy of sustaining life, and carrying on its functions. As an example, take a couple of jars, fill one with common air and the other with oxygen, and put a live mouse, bird, or rabbit, under them, we shall see that after a time, in both jars, they would exhibit symptoms of distress, and at last die; but the common air would not be found sufficient for their existence for one-third so long a time as the oxygen gas. The red matter of the blood is composed of globules or cells of a flattened form, and slightly red colour. These blood globules seem to act the part of carriers of oxygen from one part of the system to another; so that they are the active agents by which the animal heat is kept up. It is by the agency of the blood that the oxygen gas of the atmosphere is absorbed in the lungs, and which, coming in contact with the carbonaceous matters of the system, previously prepared in the liver, unites them, forming carbonic-acid gas, and generating the heat of the animal system. The blood carries the carbonic-acid gas to the lungs, where it is expelled at the same time that the oxygen gas is taken in. I have thus been particular in explaining the nature of oxygen, and its peculiar action in the animal economy, to show its importance as a remedy in cholera; and its applicability in other diseases, where, we have reason to believe, it might be beneficial, or where we have reason to suspect that the want of this gas—pure as it is to be found in a healthy atmosphere—has been the cause of these diseases, quantity and quality is essential to health and the continuance of life. When blood is drawn from a choleraic patient, it is dark and thick, and will scarcely flow from the orifice, which shows that it is either wholly or in part divested of its oxygen; or that this gas, so absolutely essential to life, has been so vitiated by a deleterious or poisonous mixture in the atmosphere, as to render it unfit for its office, as a supporter and continuator of life.

Pure oxygen has been used with success in asphyxia, or the apparent cessation of life in new-born infants, and where the blood presents the same appearance as it does in cholera;—in fact, the infant in these cases is in a state of collapse, from the absence of a necessary stimulus—this stimulus being oxygen. It acts by removing

spasm, and reducing the blood to a proper state of fluidity, giving it impetus, and imparting to it heat and vitality. Asphyxia is a Greek word, and signifies a cessation of the pulsation. It originally expressed any state of disease in which there was a suspension or loss of the heart's action, and consequent failure of the pulse; but the term is now used to denote a suspension or loss of the power of respiration. The state of asphyxia is that in which the respiratory actions are either temporarily suspended, or have wholly ceased—a state necessarily inducing such a change in the nature of the blood as is incompatible with the continuance of life. Oxygen, when taken pure—as it is necessary to give it in cases such as the above, suspended animation, &c.—causes much increase of heat over the body, but especially about the region of the lungs; but when diluted with common air, in ordinary cases, the proportion of one to eight, and even as far as one to twenty, it is then a safe and useful remedy, whose principal action consists in giving tone, elasticity, and consistency to the fluid, as well as to the solid parts of the body; and, of course, it promotes all the natural consequences of those effects. It quickens languid circulation, it strengthens the organs of digestion, promotes secretions, invigorates debilitated habits, and assists nature in throwing off bad humours and other causes of lurking diseases. It may be taken into the lungs by means of an inhaler, and if we wish to impregnate the air of the apartments of those labouring under cholera, we can readily do so by an apparatus for that purpose. Factitious airs were at one time much employed in the cure of disease; but like iodine, and some other favourite remedies, in many instances too much was expected from them, and they were often used in cases contra-indicated, injudiciously, and unscientifically; and they consequently fell into disrepute and disuetude, and are now nearly forgotten, except for purposes of disinfection, for which they are still used and highly recommended, and deservedly so, as experience can attest. Except where there is great exhaustion, and the powers of life nearly worn out, no spirituous stimulants—no brandy, no laudanum—allowed under this treatment; but tea or coffee, or other bland fluids and condiments, judiciously administered, are of use. Infusions of Cayenne pepper and peppermint tea are good, but should never be given in quantity—just a little now and then. In this way there is much less fear of reaction—a disease nearly as formidable as the original one—than when spirituous stimulants are given, and poured *ad libitum* down the throats of the unfortunate patients and sufferers, and on a raw surface, as the stomach and intestines are frequently found inflamed, and, in many instances, ulcerated.

The only way in which laudanum is admissable, as a general practice, is in the form of embrocation, combined with turpentine rubbed over the parts affected with spasm, as already recommended ; hot applications to the stomach and feet must not be neglected. Should the patient recover after the use of these means, which there is every reasonable ground for believing he would, I should advise, if he resides in a low, damp situation, his removal to a more airy and dry one, if possible, and into a purer atmosphere ; but still, the use of the oxygen to be had recourse to occasionally, or until he was completely convalescent, and every symptom of the disease had totally disappeared. As ventilation is of the utmost importance, especially in overerowed apartments and the dwellings of the poor, I should advise ventilators to be put up in the windows of all such places ; they are cheap, being made only of tin painted, and easily and speedily executed, and, in ordinary cases, will answer the purpose very well. The chimneys and flues should also, with a view to the same object, be regularly swept and cleaned, so as to allow of a proper draught. The best method to purify the air of an apartment will be obvious, if we consider the influence which heat exercises on the atmosphere. Air is expanded and rendered superficially lighter at the ordinary temperature on the application of heat. Hence, in every room heated above the temperature of the atmosphere, there is a continual current of air in circulation. The hot air in chimneys ascends and creates a draught towards the fireplace, while the hot air in churches, theatres, and other buildings, passes through the grating in their ceilings, and its place is supplied with the flow of cold fresh air through the windows and doorways in the lower parts of these buildings. Hence, to ventilate an apartment thoroughly, it is only necessary to kindle a good fire, and let the air have free access through the doorway and windows. The fire will create a current of fresh air in the apartment, and its atmosphere will be thus kept continually changed. As a disinfectant, I should advise the ehloride of zine in preference to any other ; it may be a little dearer than the chloride of lime, but its superior efficacy will amply compensate for the difference in price. It is evident from what has been seen of eholera, that this extraordinary disease is owing to a want of oxygen in the blood, by which heat is engendered in the system and the principle of life sustained. Want of warmth is always a prominent symptom, and the recovery or death of the patient in proportion to the presence or absence of this symptom. A pamphlet, entitled " Practical Observations on Contiuent Cholora, &c.," by an eminent member

of the medical profession, Mr., now Sir John Fife, of Newcastle-on-Tyne, in 1831, goes, I think, to establish this view of the question, and the truth of the theory I have been endeavouring to explain. Oxygen, as already stated, is the source of heat to the whole system—in fact, the life of the body, without which it cannot exist. The following is an extract from the pamphlet just mentioned, and which pamphlet, observe, is a digest of the opinions entertained of this disease by eminent medical writers, colleges, and commissions of inquiry in different countries:—"The favourable or unfavourable symptoms," he says, "are chiefly to be looked for in the state of the pulse and skin—in fact, the danger might almost be said to be directly in proportion to the diminution of temperature. When the skin retains its natural heat, or having been cold, resumes its warmth, and when the pulse continues tolerably firm, showing that the circulation is performed with a certain degree of power, recovery may reasonably be anticipated. On the other hand, the worst is to be feared so long as the surface continues cold. In some cases the thermometer, even under the tongue, or in the axilla, does not rise above 90 degrees, being a diminution of seven or eight degrees." Judging from the evidence of many reports which we have consulted, we should say that the danger has a more obvious relation to the circulation and heat of the body, than to the vomiting, purging, or cramps. In fact, many of the phenomena resemble those of asphyxia. If blood be drawn, it is found to be unusually dark—some describe it as "jet black;" and that taken from an artery, instead of its proper vermilion, is often darker than the usual modeua hue of venous blood. Corresponding with this, it was found more than ten years ago, by Dr. Davy, brother of the distinguished Sir Humphrey, that the air did not undergo the usual change in respiration, was not converted into carbonic acid, and, consequently, did not free the blood from its superabundant carbon. Only from one fourth to one third of the usual quantity of carbonic acid was found in the air respired by those labouring under cholera. Similar observations have subsequently been made by others, and thus it appears, that one of the striking phenomena of the disease is imperfect arterialization of the blood; and in the account of the cholera, published by the Medical College of the kingdom of Poland, they incline to the opinion that a morbid change of the blood is the cause of the disease. "For all observations," say they, "tend to show, that the blood during the patient's life, as well as after death, has undergone some morbid change. It is black and thick; where such blood occurs, the secretions must be altered from their healthy

state, and the nerves be disposed to show their vitality by increased activity, thus producing spasms."

Now, what is the principal fact to be deduced from the opinions I have just quoted? Why, clearly and conclusively, that the want of oxygen in the blood, either in proper quantity or quality, or both, is the cause, the *sole* cause, of Asiatic cholera. It follows, then, as a natural consequence, that the cure consists in supplying this deficiency—in the administration of oxygen, pure or diluted, according to the symptoms or stage of the complaint, its urgency or otherwise, the age of the patient, and other collateral circumstances, all of which must be left to the judgment and direction of the medical attendant.

In this complaint the laws which regulate the animal system in a state of health and activity are reversed, and the entire machine, as it were, thrown back upon itself, deranged and disordered. The white evacuations, by vomiting and purging, appear to be the contents of the lacteals forced back as they empty themselves into the thoracic duct, mixed with phlegm, or other viscid substance. In fact, the entire phenomena of the complaint can only be accounted for by the *absence of* oxygen in the blood, which immediately causes a revolution in the whole system, and which nothing can so effectually and quickly counteract as the wanting agent.

Oxygen might be used with advantage in all cases of apparent death, or suspended animation from whatever cause—in suffocation from charcoal, or any of the poisonous gases in coal-pits, and in suffocation from drowning it might prove highly useful. Drowning is a case of merely suspended animation, in which life is not extinct, but, if I may use the expression, in a state of dormancy; and if we could find means to rouse it from its lethargy, it would be a great acquisition to science, as well as a blessing to mankind. Now, I think we possess in oxygen, if judiciously used, a powerful agent for this purpose. Drowning is a state of asphyxia produced by the immersion of a warm-blooded animal under water.

The change in the system produced by continued submersion, the consequent suspension of respiration, and the necessary extinction of life, are all referable to one pathological condition, namely, a change in the nature of the blood. The water prevents any portion of air from entering by the trachea to the air vessels of the lungs, consequently, no air comes in contact with the venous blood contained in the capillary branches of the pulmonary artery, which are spread out upon the walls of these air vessels. The venous

blood, which flows to the lungs, is therefore incapable of being converted into arterial blood, whence the lungs can deliver to the left side of the heart only venous blood, to be sent out to the system. As the circulation goes on, all the arterial blood in the body is at length converted into venous, and flows into the great venous trunks of the system, by which it is returned to the right side of the heart, and thence to the lungs, where it undergoes no change, but remains venous. These currents of venous blood, and of venous blood only, are successively sent out to the system. But venous blood is incapable of maintaining the action and vitality of the brain and spinal cord, of the heart, of the voluntary muscles, or of any organ of the body, and, consequently, when nothing but venous blood circulates in the system, the death of all the organs is the sure and quick result. Sensibility and the power of voluntary motion are diminished the moment the arterial blood loses its vermilion colour. An animal is completely insensible, and has wholly lost all power of voluntary motion,—that is, it is in a state of apparent death, as soon as the arterial blood is completely venous. In one minute and a half, then, after complete submersion, animal life is completely extinguished, but by the prompt and vigorous use of the appropriate remedies, recovery from this state is possible, because the organic functions go on for a considerable time after apparent death, and death is not real until the organic functions have wholly ceased. Nevertheless, though the organic functions may continue for an indefinite period after the animal functions are extinguished, from ten minutes to half an hour or more, yet in no instance in which the experiment has been fairly tried has any adult warm-blooded animal that has been completely and continuously submersed for the space of four minutes been capable of resuscitation, though all the means of restoring animation may have been instantaneously, and most actively and judiciously employed. Accordingly it is found, in practice, the immediate and vigorous use of the best means for restoring animation often fail when the person has not been in the water more than four minutes. This is certainly suggestive of an improvement in the method at present in use for recovering the drowned; and the improvement I now recommend is oxygen gas. Let it be thrown into the lungs as soon as possible, and persevered in for some time. In such deplorable accidents as drowning, and they are unfortunately of frequent occurrence, every means should be tried that has the remotest possibility of restoring life.

The facts and observations contained in the foregoing pages were written and prepared for the press during the last prevalence of cholera in 1853, but from causes which it would not interest the reader to know, their publication has been deferred till now ; and it will give the author unfeigned satisfaction if they are productive of good to the public, and be the means of calling forth a more earnest spirit of inquiry on the subjects thus briefly treated of.

